EVALUATION OF PALES WEEVIL DAMAGE AND RECOMMENDATIONS FOR FUTURE MANAGEMENT ON THE CHATTAHOOCHEE N.F.

John H. Ghent
Clair H. Redmond

INTRODUCTION

The rising demand for and value of forest products derived from a decreasing land base points out the need for rapid reforestation; i.e., replanting the site at the earliest opportunity. To ignore this management practice may result in increased vegetative competition, increased cost of site preparation, and the extention of the site's rotation age, resulting in a loss of one or more year's production. One of the major drawbacks facing land managers who practice rapid reforestation is the risk of attack of newly planted seedlings by pales weevil, Hylobius pales Herbst.

During the summer of 1982, three regeneration areas on the Chattahoochee National Forest showed high amounts of mortality due to attack by pales weevil. Mortality ranged from 25 percent to 60 percent. This report discusses the pales weevil biology, hazard rating system, future control recommendations, preventative measures, and an economic analysis of various cultural and chemical recommendations.

Biology

Adult weevils are attracted into areas where pines have recently been cutover or killed by bark beetles, fire, etc. Here, they begin to feed on the inner bark of freshly cut slash and stumps. Later, they feed on the small twigs of residual pines and stems of small pine seedlings. All feeding occurs at night; during the day, the insect hides in debris or in the soil.

The eggs are usually laid in small niches chewed in the bark of the subterranean parts of stumps and roots. Although pales weevils may oviposit on aboveground slash and logs, survival occurs only under bark in contact with the ground. The larvae bore irregular tunnels under the bark, scarring the wood more deeply than the phloem. After passing through 5 to 6 instars, it pupates in a shallow cell made in the outer surface of the wood. This cell, called the "chip cocoon," is sealed with excelsior-like chips of wood.

The development of larvae is probably temperature dependent, with adults emerging from stumps and roots between 3 to 12 months after trees are cut. In most of the South, emergence from pine residue in areas cut before June occurs in the summer and fall of the same year. From pine areas harvested in June, part of the population emerges in the fall and part the following May and June. Emergence from trees cut in July and after occurs from late spring through late summer of the following year. Since serious seedling damage occurs from February to late May, it is evident that most of this weevil damage is caused by overwintering adults, rather than brood adults produced in the area. The weevils originally attracted into areas harvested after June overwinter there.

Examination of Damage

During the summer of 1982, three regeneration areas were examined to confirm the presence of pales weevil and determine the amount of mortality. The three areas were previously harvested during the summer in July, August, and September 1981, and experienced regeneration mortality by pales weevil of 25 percent, 30 percent, and 60 percent, respectively.

DISCUSSION

The fact that these areas experienced high levels of mortality is not surprising. A hazard rating system has been developed for the South, which provides the land manager with a method for determining the potential for weevil damage. The rule-of-thumb is:

- Pine lands cut and site prepared before late June are safe to plant the following winter without weevil damage. However, on pine lands harvested after late June, or in older harvest areas where residual pine is cut during late summer or fall site preparation, planting should be delayed one year or seedlings should be treated with insecticide to prevent weevil-caused mortality.

Control Alternatives and Economic Analysis

If planting on recently cut pine lands is delayed one year, the weevils will not be in the area where seedlings are planted. Although this solves the weevil problem easily, it is rather expensive to allow land to lay idle that could otherwise be replanted during the first available planting season. The decision to replant high hazard areas assumes that the present value of the eventual timber return gained through immediate regeneration is greater than the present value of the control cost. The value of this one year's growth and the cost of the delay increases with site quality and the intensity of management. Thus, intensively managed sawtimber stands with a high site index will provide greater economic gain than pulpwood stands, and the more profitable it would be to invest in control.

Tables 1 and 2 present a comparison between control alternatives. The economic analysis of these alternatives allows a comparison by five site indexes, four registered chemical treatments, and rotation ages of 30, 50, and 80 years. Table 1 uses a discount rate of 4 percent, and Table 2 is for 10 percent.

For the analysis, it was assumed that the stand to be planted would be an adequately stocked loblolly stand (550 seedlings per acre) and managed throughout its life to maximum productivity. Stumpage prices were assumed to increase by a compounded yearly average of 2 percent from a base of $20 per cord and $120 per thousand board feet. It was further assumed that the cost of seedlings, site preparation, and planting cost was $135 per acre for a site located on National Forest land. In year "0" for sites chemically treated, the cost of chemical treatment was added to the cost/acre to site preparation and to plant the seedlings. When the preceding stand was cut before July 1, pales weevil will not be a serious problem; therefore, the only cost involved is the site preparation and planting charge.

Table 1

Cash Flow Analysis of Pale[illegible] Prevention Using Chemicals, Allowing Site to Lay Fallow, and Cut Previous Sta[illegible]e July 1

Year	Activity	Per/Acre Yield @ Site Index					Value at Rotation					Cost/Acre	Net Present Value at 4%				
		60	70	80	90	100	60	70	80	90	100		60	70	80	90	100
0	Plant, site prep. for preceding stand cut after July 1											$ -135					
	Treatment of seedlings/acre:																
	Furadan 10 G											-6.65					
	Imidan 50 W											-2.35					
	Dursban M											-3.45					
	Furadan 4 F											- .65					
	Plant, Site prep. for preceding stand cut before July 1											$ -135					
1	Plant, site prep. scenario when one year wait is chosen											-135					
30	Treated seedlings harvested for pulp	2150ft^3	2700ft^3	3250ft^3	3850ft^3	4550ft^3	$868	$1087	$1308	$1550	$1831						
	Furadan 10 G												$126	$193	$262	$336	$363
	Imidan 50 W												130	198	266	341	368
	Dursban M												129	197	265	339	367
	Furadan 4 F												132	199	268	342	369
	Seedlings from site cut before July 1 harvested for pulp												133	200	269	343	370
31	One year wait scenario harvested for pulp												127	192	258	330	413
50	Treated seedlings harvested	3600ft^2	4350ft^2	5200ft^2	6150ft^2	7200ft^2	$8952	$10,817	$12,935	$14,889	$17,910						
	Furadan 10 G												$1118	$1380	$1678	$1953	$2379
	Imidan												1122	1385	1683	1958	2383
	Dursban M												1121	1384	1682	1957	2382
	Furadan 4 F												1124	1386	1684	1959	2385
	Seedlings from site cut before July 1 harvested for sawtimber												1125	1387	1685	1960	2386
51	One year wait scenario harvested for sawtimber												1081	1334	1620	1884	2293
80	Treated seedlings harvested for sawtimber	4350ft^3	5250ft^3	6250ft^3	7400ft^3	8700ft^3	$19,594	$23,651	$28,155	$33,338	$39,193						
	Furadan 10 G												$708	$884	$1080	$1305	$1559
	Imidan 50 W												713	889	1084	1309	1563
	Dursban M												712	888	1083	1308	1562
	Furadan 4 F												714	890	1086	1311	1565
	Seedlings from site cut before July 1 harvested for sawtimber												715	891	1087	1312	1566
81	One year wait scenario harvested for sawtimber												687	857	1045	1261	1505

Table 2 Cash Flow Analysis of Pales , Prevention Using Chemicals, Allowing Site to Lay Fallow, and Cut Previous Stan e July 1

Year	Activity	Per/Acre Yield @ Site Index					Value at Rotation					Cost/Acre	Net Present Value at 10%				
		60	70	80	90	100	60	70	80	90	100		60	70	80	90	100
0	Plant, site prep. for preceding stand cut after July 1											$ -135					
	Treatment of seedlings/acre:																
	Furadan 10 G											-6.65					
	Imidan 50 W											-2.35					
	Dursban M											-3.45					
	Furadan 4 F											- .65					
	Plant, Site prep. for preceding stand cut before July 1											$ -135					
1	Plant, site prep. scenario when one year wait is chosen											-135					
30	Treated seedlings harvested for pulp	2150ft^3	2700ft^3	3250ft^3	3850ft^3	4550ft^3	$868	$1087	$1308	$1550	$1831						
	Furadan 10 G												$-92	$-79	$-67	$-53	$-37
	Imidan 50 W												-88	-75	-62	-49	-32
	Dursban M												-89	-76	-63	-50	-34
	Furadan 4 F												-86	-73	-61	-47	-31
	Seedlings from site cut before July 1 harvested for pulp												-85	-72	-60	-46	-30
31	One year wait scenario harvested for pulp												-73	-66	-55	-42	-28
50	Treated seedlings harvested	3600ft^2	4350ft^2	5200ft^2	6150ft^2	7200ft^2	$8952	$10,817	$12,935	$14,889	$17,910						
	Furadan 10 G												$-65	$-50	$-31	$-15	$ 11
	Imidan												-61	-45	-27	-11	15
	Dursban M												-62	-46	-28	-12	14
	Furadan 4 F												-59	-44	-25	- 9	17
	Seedlings from site cut before July 1 harvested for sawtimber												-58	-43	-24	- 8	18
51	One year wait scenario harvested for sawtimber												-54	-39	-23	- 8	16
80	Treated seedlings harvested for sawtimber	4350ft^3	5250ft^3	6250ft^3	7400ft^3	8700ft^3	$19,594	$23,651	$28,155	$33,338	$39,193						
	Furadan 10 G												$-132	$-130	$-128	$-125	$-123
	Imidan 50 W												-128	-126	-124	-121	-118
	Dursban M												-129	-127	-125	-122	-119
	Furadan 4 F												-126	-124	-122	-119	-117
	Seedlings from site cut before July 1 harvested for sawtimber												-125	-123	-121	-118	-116
81	One year wait scenario harvested for sawtimber												-114	-113	-111	-108	-106

Imidan 50W, Furadan 10G, Dursban M, and Furadan 4F are the chemicals compared in this analysis. The retail cost of the chemicals was prorated according to the quantity of chemical needed to treat 550 seedlings. Also, where applicable, a labor charge was added to the cost per acre for application of the chemical. Best estimates on these measurements were obtained from private industry, and the cost per acre for the four chemicals are as follows:

1. Furadan 10G - $6.65
2. Imidan 50W - 2.35
3. Dursban M - 3.45
4. Furadan 4F - .65

Revenues at rotation ages of 30 (pulpwood stumpage prices), 50, and 80 years were discounted to present at 4 percent and 10 percent discount rates and netted with the planting costs and chemical treatment costs. For the fallow site alternative, the cost was the extra year that the site would not be productive; therefore, its revenues were discounted an additional year and subtracted from the present value of the planting cost ($130 at 4% and $123 at 10% discount rates). The alternative of cutting the previous site before July 1 had no costs other than site preparation and planting costs for the regenerated stand.

Taking all variables into account at the 4 percent discount rate, the forestry investment is profitable; however, at 10 percent, virtually all rotations show no positive cash flow (the exception is at rotation age 50, site index 100, see Table 2). Also, in virtually all cases where the preceding stand was cut after July 1, chemical treatments produce superior cash flows than would occur if the site was allowed to be unproductive for one year (exceptions to this generalization occur in rotation year 30, site index 60). Using site index 80 as an average site at rotation 30, 50, and 80 years, the most costly chemical treatment, Furadan 10G, returns $4, $58, $35 more per acre, respectively, over the fallow site alternative for a forestry investment valued at 4 percent, or for the 300 acre site on National Forest land in north Georgia, for which this analysis was prepared, a savings of $1,200, $17,400, and $10,500 for rotation ages of 30, 50, and 80, respectively. The alternative which allowed the previous stand to be cut before July 1 was superior to all other alternatives because no additional cost in time or chemical had to be expended.

The internal rate of return, or the interest rate that causes discounted revenues to equal costs, is between 7 and 10 percent for these investment scenarios, except at rotation age 50, site index 100, where the rate is slightly more than 10 percent.

SUMMARY

Using chemicals is a more superior regeneration method than allowing the ground to lay fallow in virtually all situations where the previous stand was cut after July 1. However, when possible, the most preferred alternative is to cut the previous stand before July 1, so that pales weevil will not be a problem upon regeneration of a succeeding stand. In descending order, the rank of the chemical over the fallow ground alternative is Furadan 4F, Imidan 50W, Dursban M, and Furadan 10G. The internal rate of return on the forestry

investment is between 7 and 10 percent for most of the case variables considered in this analysis, and the maximization of the forestry investment occurs at rotation age 50 where the discounted revenues less costs are the greatest.

APPENDIX

Chemical Control Alternatives

Imidan Top Dip (Imidan 50W®)

Treatment.--The tops of seedlings are dipped down to and including the root collar in an aqueous suspension of 4 percent active ingredient Imidan (Nord et al, 1978). An adjuvant, either Plantgard® or Nu-Film 17® mixed at 2.7 percent (14 oz./4 gal.) by volume, is optional, but recommended in "hot" areas or if high rainfall is expected. (Imidan can also be used as a post-planting spray. See information under Dursban Spray.)

Operational procedures.--Seedlings in loose bunches are dipped in the suspension for 10 to 15 seconds, insuring good coverage of the lower stem. Dipping can be done at the nursery prior to bundling or bagging seedlings or at the planting site prior to planting.

Precautions.--Dip should be mixed fresh daily. Do not let stand overnight. Agitate frequently to keep the wettable powder in suspension.

Seedlings should be dipped in loose bundles. Dipping of whole, tightly packed, open-ended bundles of 500 to 1,000 seedlings should not be done unless the insecticide will penetrate and coat the entire lower stem of all seedlings. It has been determined that this rate of Imidan will not harm roots of pine seedlings (C. Doggett and J. Deines, personal communication).

When dipping seedlings in the field, rapid drying of roots will be a problem. Therefore, dip in the early morning before wind and temperature increase. Treated seedlings should be heeled-in or returned to a moist atmosphere in polybags or bundles as soon as possible.

Hand planters can use either planting bags or planting buckets. Water in planting buckets should not go above the root collar. Disposable, polyethylene bag inner liners could be used in buckets and bags to prevent a buildup of insecticide in them.

Safety.--During the mixing of Imidan 50W, a respirator, goggles, liquid-proof coveralls or apron, rubber boots, and rubber gloves should be worn. Imidan 50W is a wettable powder which should be wetted thoroughly with a small amount of water to make a slurry before adding the total amount of water. The powder will puff up out of the container and be carried by the slightest breeze during this operation, so it is imperative that a respirator and goggles be worn during mixing, and other workers should stand upwind of the mixing site. During the dipping operation, a face shield should be worn to protect the eyes and face from splashing.

Immediately after dipping the seedlings, whether in the nursery or in the field, they should be placed on a tray or shallow container to catch the excess insecticide. The excess dip can be used over, and this will prevent a buildup of toxic waste in the area. Catch additional drippings with an absorbent which can be disposed of. When Imidan dip is spilled on nursery work tables and floors and it is allowed to dry, a dusty, toxic residue will result. This residue might then be inhaled, so this should be prevented.

Furadan Granules (Furadan 10G)

Treatment.--Ten percent Furadan granules (10 grams or 1 tsp.) are broadcast in a 6-inch diameter circle around the base of the seedling at planting time and covered with a light layer of soil or incorporated into the soil (Nord et al, 1975, 1978). Granules can also be applied in the planting hole at a reduced rate.

Operational procedure.--Operationally, the granules can be applied by the planter immediately after planting or by another worker following behind him. They have also been applied in the planting hole at reduced rates (2-3 grams). In this case, the granules are metered out by an applicator attached to the planting dibble. A granular applicator on a planting machine could be devised.

Precautions.--Furadan 10G, at rates higher than recommended, is phytotoxic and may cause totally brown foliage and even cessation of growth. Therefore, care must be taken to apply the correct amount. Do not exceed 10 grams when broadcasting Furadan 10G or 3 grams in the planting hole. Brown tips on first flush foliage will probably occur with the above rates of Furadan. This is normal, and it will not affect growth rate or survival. When using the granule applicator, test it as if it were a precision tool to prevent breakage and loss of time for repairs.

Safety.--Bags should be opened and granule reservoirs loaded in an open, well-ventilated place. Persons handling and applying the granules should wear rubber gloves.

Furadan Root Dip (Furadan 4 Flowable)

Treatment.--Seedling roots are dipped or spray coated with a kaolin clay-water slurry containing 1 percent (w/w) active ingredient Furadan flowable formulation (Walstad et al., 1973).

Operational procedure.--The roots of the seedlings can be dipped or sprayed prior to bundling or bagging at the nursery. They can be sprayed in the polybags. Dipping can be done in the field prior to planting.

Precautions.--Agitate frequently to keep Furadan and clay in suspension.

When seedlings are dipped in the field, it is important to prevent drying out of the roots. (See Precautions under Imidan Top Dip above.) In hand planting operations, planters should use planting bags instead of buckets so insecticide is not washed off roots. Polyethylene bags can be used as disposable inner liners for planting bags to prevent contamination of the bag.

Safety.--When treating seedlings at the nursery, care should be taken to contain the slurry and prevent spills. This can be done by spray coating the roots inside the polybags. If roots are dipped, provision should be made for the excess slurry to drain back into the dipping tank or be absorbed by material in the bundle or polybag or material which can be disposed of periodically without contaminating work tables or the floor. Any spillage on nursery floors or work tables which is allowed to dry will lead to a dusty, toxic residue that might be inhaled at a later time. Workers exposed during the application and handling operation should wear face shields, liquid-proof coveralls, rubber gloves, and rubber boots.

Persons handling treated seedlings during the planting should wear rubber gloves. Care should be taken to disentangle roots before placing in planting bags or bins of planting machines so that spattering of the slurry is prevented. Face shields may be necessary.

Dursban Spray (Dursban M)

Treatment.--Stems of seedlings are sprayed to the point of runoff after planting with a 2 percent ingredient aqueous spray (Walstad, 1976).

Operational procedure.--Seedlings are sprayed with low pressure backpack sprayers.

Safety.--Workers should wear liquid-proof coveralls or apron, rubber boots, goggles, and respirator when mixing spray. They should wear rubber boots and rubber gloves and stand upwind while spraying.

General Safety

The supervisor must tell his employees in detail how to handle insecticides and insecticide-treated seedlings in a safe manner and what to do in case of an accidental contamination of skin and clothing. He has an obligation of not only imparting this information, but seeing to it that the employees work in a safe manner. Washing hands before eating, handling cigarettes or chewing tobacco, going to the bathroom, and before leaving the job should be stressed. Wash basins, hand washing detergent, water, and towels should be provided at the job site. Torn gloves must be replaced immediately, and workers with blisters and open sores on hands should be given jobs not involving handling insecticides or treated seedlings.

Forest Pest Management
Asheville Field Office

Report #83-1-10
December 1982

EVALUATION OF PALES WEEVIL DAMAGE AND RECOMMENDATIONS FOR FUTURE MANAGEMENT ON THE CHATTAHOOCHEE N.F. GA.

Prepared by: John Gleat
Entomologist

Clair Redmond
Economist

Approved by: Harold W. Flake
for Harvey V. Toko
Staff Director
Forest Pest Management